Information Science and Technology Directorate
Defense Technical Information Center
Ft. Belvoir, VA 22060-6218

DTIC-E-TR-2010/09 April 5, 2010
Information Science and Technology Directorate
Final Report

Investigation of Exploratory Information Needs and Information-Seeking Scenarios of DTIC End-Users

by
Bill Kules
The Catholic University of America
School of Library and Information Science

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*
05-04-2010

2. REPORT TYPE
Final

3. DATES COVERED *(From - To)*
1-6-2009 - 28-2-2010

4. TITLE AND SUBTITLE
Investigation of Exploratory Information Needs and Information-Seeking Scenarios of DTIC End-Users

5a. CONTRACT NUMBER
CSA Number: S935000009

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Kules, Bill

5d. PROJECT NUMBER
12313.104

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
The Catholic University of America
School of Library and Information Science
620 Michigan Ave., N.E.
Washington, DC 20064

kules@cua.edu, (301) 755-7982

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Defense Technical Information Center
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6218

10. SPONSOR/MONITOR'S ACRONYM(S)
DTIC

11. SPONSOR/MONITOR'S REPORT NUMBER(S)
TR-2010/09

12. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
This report reviews user needs assessment and requirements analysis techniques appropriate for DTIC to use in the design and development of information retrieval services. It reports the application of several techniques (semi-structured interviews, scenarios, personas) that were applied to investigate the exploratory information needs of a small group of DTIC end-users. It documents scenarios and personas developed from the interviews, and provides recommendations for applying the techniques more extensively.

15. SUBJECT TERMS
Information Seeking, User Needs Assessment, Requirements Analysis, Scenarios, Personas

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**			Carol Jacobson
Unclassified	Unclassified	Unclassified	UU	26	**19b. TELEPHONE NUMBER** *(include area code)* 703-767-9167

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

1 Introduction

The Defense Technical Information Center (DTIC) has contracted with The Catholic University of America to research techniques that may help it improve how it identifies user needs and conducts requirements analysis for developing information retrieval services (Statement of Work, 2009). DTIC currently uses multiple methods for end-users to provide input, but such input lacks the rigor of techniques used for software design and engineering. DTIC needs (1) research into the user needs and software requirements analysis techniques that are best suited for its information retrieval services and (2) application of these techniques to document user needs and software requirements. This research will contribute to DTIC's understanding of the potential future user needs of its user community.

1.1 Scope of Work

The project was conducted in two parts. In part 1, we researched and identified techniques and methods appropriate for DTIC to use for user needs identification and related requirements analysis. We also analyzed DTIC's current practices in these areas. As the final task of part 1, we reviewed with DTIC to jointly select specific techniques and deliverables for Part 2: user profiles, personas and user scenarios. In Part 2, we applied the selected methods to research the information needs, contexts of use, and potential system requirements of DTIC end-users.

Part 1 consisted of four tasks:

- Task 1: Review DTIC's current techniques and sources of input from end-users regarding their requirements and satisfaction with their experience using DTIC's information retrieval capabilities. Identify potential deficiencies in DTIC's current techniques.
- Task 2: Review needs elicitation and requirements analysis techniques and identify those that are suited to DTIC's information retrieval services for scientific and technical content, e.g., bibliographic information, web sites, project descriptions. Describe the utility, advantages, and disadvantages of the techniques for DTIC's employment.
- Task 3: Recommend the priority sequence for DTIC's employment of the techniques considering factors such as DTIC's end-user characteristics, applicability to DTIC's services, criticality of DTIC's information deficiencies and cost/effectiveness trade-offs.

- Task 4: Present written findings (this report) to DTIC. Review findings with DTIC to jointly determine specific techniques to apply, and deliverables to produce, for Part 2.

Part 2 consisted of 2 tasks:

- Task 1: Apply two of the recommended techniques to produce a set of deliverables documenting user needs and potential system requirements. Techniques and deliverables provided will be based on DTIC-specific characteristics, e.g., DTIC services, DTIC processes, user characteristics, system migration plans, content of DTIC's databases. Examples of deliverables include user scenarios, questionnaires, screen shots, process models, and use cases.

- Task 2: Present customized techniques to the DTIC point of contact no later than four months from the date of contract execution [note: contract was extended]. Provide electronic products in a form that is usable by DTIC without the purchase of new technology.

1.2 Principal Investigator Qualifications

Dr. Bill Kules is an Assistant Professor in the School of Library and Information Science (SLIS) at The Catholic University of America. His research interests include the design and evaluation of rich interfaces to support complex information seeking and retrieval tasks like exploratory search. Dr. Kules is an organizer of the workshops on Human-Computer Interaction and Information Retrieval (HCIR). He co-chaired HCIR 2009, was Program Chair of HCIR 2008, and is on the steering committee of HCIR 2010. He was an organizer of the 2005 Workshop on Exploratory Search Interfaces and a guest editor for the April 2006 CACM Special Section on Supporting Exploratory Search. In conjunction with his teaching, he is investigating how the library and information science field teaches students about information technology. Before joining SLIS Dr. Kules spent 20 years designing and implementing information systems for a variety of applications, include wireless telephony, customer service and banking. He earned his Ph.D. in Computer Science at the University of Maryland.

1.3 Methods

The research employed multiple methods to gather data:

- Documentation review - We reviewed documentation available on DTIC's web site and documents made available to us. All material was unclassified and unrestricted. See appendix A for a list of documents reviewed.
- One-on-one and small group interviews – For part 1, we interviewed 17 staff members from DTIC-A, B and E, either in person or via telephone. These people are involved in needs assessment, requirements analysis, design specification, and related activities. For part 2, we conducted in-depth, semi-structured interviews with 6 DTIC end-users.
- Attended executive briefing by current search engine vendor (Microsoft FAST).
- Literature review - We conducted a literature search on military information seeking and related user needs identification. We also reviewed selected user needs identification techniques in the areas of library and information science (LIS), human-computer interaction (HCI), user interface design, and systems analysis.

In part 1, data gathered from the interviews and document review was used to document DTIC's current operational process for needs identification, requirements analysis and generating design specifications. This information was used to preliminarily critique the current process. This analysis was narrowly focused on aspects related to user needs, so the documentation should not be considered comprehensive of the broader requirements analysis or design process. The literature review was used to extend our understanding of user needs identification to DTIC's domain: defense-related information seeking.

In part 2, we conducted semi-structured interviews with DTIC end-users. We contacted 17 DTIC end-users, identified through their use of DoDTechipedia or through contacts in the COCOMs. Of these, we interviewed 4 DoDTechipedia users and 2 COCOM contacts. The interview protocol was approved as exempt by the Catholic University Institutional Review Board. Each interviewee agreed in advance to be recorded. The interviews, which lasted 30-45 minutes each, were recorded, transcribed, and then analyzed to characterize these users and their information needs through the creation of personas and user scenarios, which are descriptive narratives often used in systems design and development. See Appendix B for a detailed description of the activities and Appendix C for the questions used for the interviews.

2 Assessment of Current DTIC Practices for User Needs Identification

In Task 1 we first sought to understand the current operational process for needs identification, requirements analysis and generating design specifications. We used this information to suggest initial answers to the following questions:

- Does the process consistently ensure that end-user needs are considered and addressed in design specifications?
- Are there opportunities to improve this process?
- Are there potential sources of input not being gathered?

DTIC serves a variety of end-users, from highly-trained information professionals, intermediaries and researchers (experts) to searchers without any search training (informal searchers). These are all part of DTIC's primary audience, the defense community. Traditionally, DTIC has extensive contact with the experts, and the needs of that group are fairly well understood and supported. There is a growing recognition of the need to support informal searchers. The Strategic Plan explicitly acknowledges non-traditional DTIC clients. There is an effort, for example, to make connections to the combatant commands. However, this recognition appears to be inculcated to different degrees within DTIC. My conversations suggest that much of DTIC's staff contact is with experts rather than informal searchers.

The needs of informal searchers are not as well understood as the needs of the professionals. It is not clear who comprises the informal searchers. DTIC’s User Services Directorate indicates that, "We usually advertise that we target the science, technology, research and development, acquisition, and warfighter communities. Our Web page refers to serving the warfighter, researchers, scientists, engineers, laboratories, and universities" (private communication). However, I have found no document yet that articulates the types of users DTIC seeks to serve within each of these large and diverse communities. This is an important first step in a deeper understanding of the needs of users.

During the FAST Executive Briefing, the discussion I heard suggested that the 11 Big Ideas reflect individual judgments about a small set of technological capabilities. For example, collaborative search in virtual worlds is one of the ideas, but non VR-based collaborative search interfaces were not mentioned. I did not hear reference to any user needs assessment that was guiding the decision-making. The Customer Survey might be a useful piece of data, but it

reflects a biased sample of DTIC users (mostly experts).

DTIC has multiple developmental activities, with a disparate variety of sponsors, clients, and end-users. Some projects are externally mandated, with time constraints and functional requirements explicitly defined, over which DTIC has limited control. For example, implementation timelines for both DoDTechipedia and DTIC Online Public appear to have been driven in part by external deadlines. That appears to have limited DTIC's ability to fully gather user requirements, prototype and refine the designs for these projects prior to implementation and launch.

It isn't clear that DTIC has a standard development process that is consistently applied. One interviewee indicated that they use the Scrum framework for at least some projects. In any case, I found little awareness of such a process during the interviews. This is important because having a variety of development processes makes it harder to ensure that user requirements analysis (as well as other project activities) is done consistently and thoroughly. In particular, this can lead to frustration within the organization because people with valuable knowledge of end-user needs do not have an appropriate way to contribute to the user requirements gathering process or related parts of a project (e.g. prototype reviews, informal usability testing). The Customer Interface Task Force appears to be a good step in building a cross-functional team to address this issue. It does not appear to represent the full spectrum of DTIC users.

3 Review of Selected User Needs Identification and Requirements Analysis Techniques

The initial intent of task 2 was to review techniques for identifying user needs and related system requirements. As I pursued this task, I realized that there is a precursor need: identifying who the users are. This review focuses on techniques and activities related to both aspects, after a brief review of our limited findings on military information needs. The section closes with a discussion of several general information gathering techniques that may be applicable to this project.

3.1 Military Information Needs and Information Seeking

The review of literature covering military information needs and information seeking suggests that there is much attention to battlefield information needs (Dolgoff , 1997; Kahan et al., 1989; Kuylenstierna et al., 2004; Sinclair, 1997; Thoms, 2003) and information sharing (Dearstyne, 2005; Kaiser, 2003; Feinberg, 2004; McWilliams, 1991; Stowsky, 2004). There is some discussion of the history and role of DTIC (Molholm, 1995), and the federal cataloging system (Hayes, 1992). One recent study has examined information seeking related to government information (Burroughs, 2009), although this is not specific to military information needs.

In summary, there appears to be little attention in the research and professional literature related to science and technology information needs of the military community, and no attention to trends in this area.

3.2 Identifying and Understanding Users

Stakeholders are groups or individuals that have an interest in DTIC's services (and are part of its target communities). They may be identified by group membership, e.g., formal organizations like the Department of Defense, or categories of users, like defense contractors or military service schools. Users may be identified via shared characteristics or interests, such as an interest in chemical/biological defense. They may also be identified by specialized roles (e.g., chemical engineer, teaching faculty, logistics officer, manager, program officer). It is particularly important to identify "invisible" users who rarely interact with staff (Westbrook, 45).

Segmentation is the process of classifying customers into groups with different needs, characteristics or behavior (Walters, 33-35). Identifying groups with specific patterns of information needs will allow DTIC to focus resources where they can be used most effectively and to meet the needs of previously underserved or newly developed groups. Broadly targeted services, such as online-searching capabilities through DTIC's web site, can be further developed to facilitate information retrieval for specific segments of information seekers.

Classifying groups with interests in DTIC's services can be achieved by identifying variables such as the organization that they're associated with, their particular areas of interest, the level of services that they need, or their role or level of influence within an organization. Programs and resources can be effectively developed by examining what services a particular group has available to it, the manner in which the services reach it, and the ends to which these services are applied.

Demand refers to the total number of potential customers in a particular segment. As groups are more narrowly segmented, it becomes easier to comprehend the actual demand for a product or service. Factors such as intensity of demand and timing or rhythm of demand can assist in identifying key needs for individual programs. Forecasting demand, especially in cases where a particular segment experiences fluctuations in volume or types of needs, can assist in making sure that a segment's needs are met and that DTIC's resources are prepared.

Information about users and user groups can be gathered through primary information (both quantitative and qualitative) such as questionnaires and focus groups and secondary information such as research reports and case studies. Frequently, direct information from users themselves can be supplemented and expanded upon through analytical materials to help an organization decide what direction to take with a particular resource or service.

Exposure to end-users can help in determining ways to improve a system's usability. "User roles may be similar in style of interaction, in expectation, or in terms of any of a variety of common characteristics or shared features." (Constantine & Lockwood, 71-96) "What distinguishes how a given user would or could use the system/characterizes their relationship to the system?" Different types of user roles and their dynamic relationships to each other may also affect the usability of a system as a whole.

User profiles may be used to capture demographic and other attributes of stakeholders or other

targeted populations of users. Age, education, training, experience, job functions, and common tasks may be included in a user profile.

Personas may also be used as a way to describe system users throughout the design process. Personas are fictional characters, not real people, but they are based on the behaviors and motivations of real people that have been observed (Cooper et al, 75-86). Personas often, but not always, include a name, a picture, and details such as age, education, and experience. They can include job titles as well as details about the environment they work in. Personas provide a concrete way of thinking and communicating about how users behave, how they think, what they wish to accomplish, and why. They make abstract user groups more salient, which can help designers and developers better understand and support end-user needs. Creating a persona that is broad in functionality in order to accommodate the most people will not necessarily be effective. Instead, creating a range of personas representing specific types of individuals with specific needs will enable a more realistic view of how a user might interact with a system.

The definition of user may be expanded to include those who manage direct users, those who receive products from the system, those who test and repair the system, those who make the purchasing decision, and those who use competitive products (Sharp et al, 430-431). Primary users are those likely to be frequent hands-on users of the system; secondary users are occasional users or those who use the system through an intermediary; and tertiary users are those affected by the introduction of the system or who will influence its purchase. These types of users may be found within a particular segmented group or constitute a group of their own. They may be overlooked in systems design efforts because they are not directly represented. In DTIC's case, these users could be anyone who is acquires information from DTIC, even indirectly, e.g. through an intermediary.

3.3 User Needs Assessment

Once the stakeholders have been identified, needs assessment and requirements identification can proceed. In practice, the assessment process may identify additional users, particularly tertiary users, who are not direct users of the system. In this section I survey techniques used to identify needs and requirements.

User-centered design is an accepted practice in software development. A user-centered approach means that the real users and their goals should be the driving force behind development of a system or service (Sharp et al, 2007, 425-426). In taking a user-centered approach to implementing a system user's behavior and context of use are studied and the system is designed to support them, rather than having the users adapt their behavior to the system and its capabilities. Iterative design (cycles of designing, testing, measuring, and redesigning) allows system development to be refined based on feedback. This allows the final product to evolve in a manner that is tailored to user needs, rather than simply appearing whole and unalterable.

Involving users throughout the development process will help ensure that a system will take user needs and activities into account, both for broad groups of users and specific segments of the user population. "Expectation management is the process of making sure that the users' views and expectations of the new product are realistic." (Sharp et al, 418-420) Users can be involved

in a variety of ways, from being part of the design team to participating in workshops and evaluation sessions, or just being kept informed through newsletters or announcements. User involvement can occasionally lead to problems with unfulfilled expectations and interruptions in the development process, but appropriately structured interactions with users can help prevent this. DTIC has a strong and involved user community, which can be leveraged. Because this community reflects a portion of the overall audience, additional outreach would be needed to users not already represented.

Asking users to identify their needs can be tricky because users are not always aware of what's possible. "Instead, we have to approach it by understanding the characteristics and capabilities of users, what they are trying to achieve, how they achieve it currently, and whether they would achieve their goals more effectively and have a more enjoyable experience if they were supported differently. Introducing a new product to the user population requires a culture change, which is not always easy to create. (Sharp et al., 2007, 432-433) A system designed to reference back to users' previous habits and behaviors can help ease the transition. Thus some system requirements may be transitional.

System design involves multiple forms of data gathering, including: interviews, focus groups, questionnaires, direct observation, indirect observation, studying documentation, researching similar products. Data on user needs must cover a wide spectrum of issues, so it's preferable to take a variety of approaches to expand, clarify, and confirm the data that is out there. "We need to find out about the tasks that users currently perform and their associated goals, the context in which the tasks are performed, and the rationale for the current situation." (Sharp et al., 2007, 489-500). Interviews can be effective in the early stages of development for getting people to explore issues and describe scenarios that can be used for identifying problems with the current system and suggesting alternatives. "Focus groups are good at gaining a consensus view and highlighting areas of conflict and disagreement during the requirements activity." Focus groups can help in gaining an understanding the particular needs, attitudes, and problems of targeted segments of user population (Walters, 2004, 55-60). Focus group participants should be chosen for their similarities to one another with regard to the issues that the focus group will be discussing, rather than as representatives of a diverse user population. Personal interviews may allow a researcher to dig deeper into a particular issue and provide an opportunity for researchers to gain more complex answers to their questions. Interviews and focus groups are flexible and relatively easy to organize. They provide the opportunity to ask and follow up on detailed questions. Their small sample size means that they provide anecdotal rather than comprehensive data.

Questionnaires can be effectively used to gain perspective on specific issues throughout a broad spectrum of users and initiate feedback/suggestions. In the government environment, fielding a questionnaire requires review and approval by the Office of Personnel and Management, which adds time and complexity. In addition, questionnaires must be publicized or otherwise presented to that target community and incentives may be needed for completion. Nevertheless, questionnaires are efficient tools for reaching a large population of users to address specific, quantifiable questions.

Direct observation of users in their regular settings can assist in understanding the context under which a user engages in activity with a system and the types of tasks that are used to fulfill their needs. Indirect observation, such as diaries and interaction logging, can be used to gain similar information without intruding on the user environment. Contextual inquiry is a specialized form of direct observation, wherein the designer adopts a role similar to an apprentice to the user. During a contextual interview the designer and user work collaboratively to observe, discuss and interpret the user's tasks and activity in a system. Any of these techniques require on-site access to users and the willingness of the informant to be observed and possibly interrupted with questions. Security constraints and the disparate location of DTIC users reduce the viability of this approach for DTIC.

Documentation such as manuals and help logs can provide useful information on the steps involved with specific tasks and where users are currently experiencing problems. Researching similar products and performing competitive evaluation can generate alternative designs and prompt ideas for new system requirements. The documentation of interest in this project is unlikely to be classified, although it may be intended for limited distribution.

User scenarios provide narrative descriptions of user tasks that allow for exploration of user needs and system requirements (Sharp et al., 2007, 505-518). They can be developed through a number of techniques, including focus groups and expert consultation. User scenarios use the vocabulary and phrasing of users and provide a natural way for people to explain how they're doing things and highlight potential design ideas for a new system. Scenarios detail how their characteristic elements interact with each other (Carroll, 200, 46). For example, the setting, actors, events, and goals can all interact with one another and change the nature of other elements or the task at hand altogether. They provide an explicit description of how a task is handled and the variables that influenced the decisions made by the user, as well as the ultimate outcome. This is particularly useful when designers and developers are not familiar with the end-users, as is the case with DTIC's non-traditional end-users. User scenarios can provide insight into why users do or do not use a system; environmental or organizational constraints that affect their use of a system; and what capabilities or services they might find valuable in satisfying information needs and achieving business objectives.

Another technique, use cases, can provide similar information, but it differs from user scenarios in that the focus is on describing the user-system interaction through a dialog approach. Use cases typically include multiple possible outcomes, whereas user scenarios focus on one specific example. However, in both techniques the focus is still "on the user's perspective, not the system's."

Hierarchical Task Analysis (HTA) is used to investigate existing situations by breaking a task into subtasks, and then further into subtasks as necessary. This provides a high level of detail for examining how a complex system works as a whole. It is appropriate when specific tasks require a detailed understanding or when there are a few ways of achieving the task that are to be optimized. In the context of information seeking, HTA is more appropriate for detailed system design rather than the long range, high-level focus of this project.

"The overall purpose of requirements analysis is to determine user, stakeholder, and

organizational needs." (Stair & Reynolds, 2008, 511) Requirements analysis specifically asks the involved parties about their satisfaction with the current system and what improvements could be made to the system in order for it to function more effectively. It can help determine Critical Success Factors (CSFs), aspects that are vital to the success of an organization. CSFs can be materials or information that are retrieved or acquired through the system and allow other processes to occur or continue. As with HTA, CSFs are more appropriate for detailed analysis and design tasks.

3.4 Other Techniques

The techniques detailed above are well accepted for defining current requirements for a system. That is, they are useful for eliciting current needs. Since the focus of this project is to identify future needs, DTIC should also consider techniques that are more "forward looking." There are several ways to do this.

Workshops (essentially focus groups of experts) are used in the research community to investigate specific aspects of a topic. They provide a forum for focused discussion and consensus-building. One to two day workshops can be structured to yield clarify a question, generate recommendations, or critique an approach. In the context of this project, a workshop could be used to identify important trends in information needs and behaviors and develop a list of anticipated information needs. Unlike other focus groups, workshops require extensive planning. Experts need to be recruited, their schedules need to be coordinated well in advance, and they need to be compensated for their time and travel. The workshop needs to be carefully structured and facilitated. Participants may need to be asked to do pre-work. Experts bring their own biases, so workshop organizers need to be aware of them and recruit a balanced group. Nevertheless, if the expense and scheduling constraints are acceptable, workshops can be very effective tools.

Case studies provide in-depth knowledge based on existing, real-world systems organizations or systems. Case studies can be conducted relatively inexpensively, because typically one or two people conduct the research and analysis. Typically one organization or system is selected for the study. A structured set of information is compiled and analyzed to answer specific questions. Although case studies may involve other techniques, such as interviews or focus groups, they rely heavily on existing documentation. Thus, they are limited by the availability of informants and documentation. Since the focus is on the present or past, they are not inherently forward-looking, although the findings can be used to suggest future trends.

Environmental scans can provide early detection of important trends. Scans may be a one-time or ongoing activity. They depend on having a broad set of resources that can be effectively monitored and analyzed. Scans are limited by the quality and timeliness of the resources. In the context of this project, a scan would need to include research journals related to information needs and behaviors, especially of the "Millennial" and succeeding generations. These would include journals, conferences and workshop in the LIS field, as well as education, sociology, human-computer interaction (HCI), psychology, and other fields.

4 User Profiles, Personas and Scenarios

Following discussion of the part 1 findings, we agreed to apply three techniques, producing the following three types of user and task descriptions:

- User profiles
- Personas
- Scenarios

4.1 User profiles

For this study, we collected a small set of attributes for the user profiles (see Table 1):

- Position
- Education level
- Gender
- Age (range)
- Work experience – both in the field and at the current job
- Web search frequency and experience

Table 1. User profiles of the six end-users interviewed in part 2 of the project.

Position	Educ. Level	Gender	Age	Years in field	Years at this job	Web search frequency	Web searching skill
Scientist, USNR officer, technical consultant, DDR&E	PhD	M	50-59	22	6	Daily	3.5
Analyst, contractor, ASDNII/DoD CIO	n/r	F	n/r	n/r	n/r	Daily	4.5
Civilian analyst, NAVSEA	Some college	M	50-59	35	6	Daily	4.5
Systems analyst, contractor, MDA	MS, MBA	M	50-59	30	n/r	Daily	4.5
Systems analyst, contractor, DDR&E	BS	F	30-39	10	0.5	Daily	4
Analyst, AF Space Command	BS, MS	M	40-49	23	n/r	Daily	4

4.2 Personas and Scenarios

From the six interview transcripts, I created four personas and seven scenarios of information needs. Specific personal and task details have been merged and altered to avoid directly identifying individuals while remaining true to the information need, sources consulted and search strategies and tactics.

Charles – Industrial process improvement

Charles is responsible for process improvement in naval shipyards. He regularly looks for specific technical ways to improve operations. He also looks for resources to help large organizations change technical cultures and improve communication in distributed organizations. He uses DoDTechipedia extensively to share new ideas and techniques with tradesmen around the country. He does not currently use other DTIC services much because he finds them "cumbersome" even though they may contain useful information.

Specific Need - Charles is researching an application of the Metal Inert Gas (MIG) welding process applicable to working with assault amphibious vehicles (AAV's). He does not know where to begin to look for authoritative information sources on this application, so he starts with Google. Google returns a result set which includes the Electric Welding Institute. Although he didn't expect to find a result from this organization, he knows of it and is already a member, so he logs in and from there locates specific, known information and also "joins the conversation" to ask how to apply this process in the Navy yards. He spends a total of about half an hour on this search.

Exploratory Need - Over the next several weeks, in small chunks, Charles continues searching on this application of MIG welding. His goal is to better understand the current limitations of the

process and look for improvements. The Electric Welding Institute is already a marked "favorite" of his. Marking a web resource as a favorite enables him to easily recall known resources that he has previously found and vetted. As part of his ongoing research, he looks for availability and configuration information for the machines and tools needed. With each search, he takes the inquiry further in anticipation of addressing potential concerns that the welders might have. This yields no additional technical information but puts him in touch with more subject matter experts. He ultimately decides to continue monitoring the technique so that it can eventually be considered for field applications.

Roberta – Technical analyst

Roberta works for the Air Force Space Command. She is involved in a variety of tasks related to information systems - some strategic planning, contract administration, architecture and engineering. She searches the web daily. She uses DTIC services less than once a month. She hasn't yet found relevant content on DoDTechipedia.

Exploratory Need - Roberta hears about the IT Infrastructure Library from a colleague and wants to learn more about it to improve the quality of her document reviews. She starts with a Google search and finds the official web site, but she wants information that will help her directly apply this within MDA, so she continues searching, using Google and the AF Portal. Her searches frequently return results that appear promising, but turn out to be a vendor site or some other resource which requires subscription for information. She looks for the best sources that are not charging for the information, because expending funds every time for sources she encounters presents budget, time and aggravation factors. After spending about 4 hours over 2-3 weeks, she gets several book recommendations from a contractor she trusts, and gets authorization to buy them.

Sam – Systems Analyst

Sam is a systems analyst in the Missile Defense Agency. He supports the COCOMs by researching items on their integrated priority lists, in particular looking for organizations that can support specific needs. As part of his job he also manages a science and technology (S&T) community page with information about upcoming conferences, points of contact, a blog and a discussion area. He spends "a good chunk" of each workday searching for information for his job. Most of the time, he uses the web. He monitors DoDTechipedia and uses other DTIC products a few times per week.

Specific Need - Sam needs to find an official organization chart for part of the MDA. He starts with the MDA portal, entering a search for "organization chart." He revises his query several times, uses Boolean combinations of AND and NOT, and examines the results. After two hours he finds an unofficial version, but not the official one. He is frustrated because he is unable to narrow his search by file format which would give him the executed (approved) version.

Exploratory Need - Sam needs to know what is not working well for the deployable force protection teams and what kinds of S&T solutions are available, either inside or outside the DoD. He starts at the point of what is known about a given problem and searches using

DoDTechipedia first. He then searches on DTIC's unclassified and classified systems. Next he takes an "outside" perspective, using Google to see what parallel information is available from the civilian or commercial content and knowledge environment. He also monitors specific known web sites. For example, a main source of information regarding incidents for this team is JIEDO, which provides after-action reports on IED incidents with the force. He monitors these reports, as well as other internal and external sources, on an ongoing basis. He shares his findings with his team and other working groups.

Alan – USNR officer

Alan is an expert in radioactive materials, which involves him in both civilian and military working environments. He is retired from active duty in the US Navy, and is a Captain in the US Naval Reserves. He is a radiation safety officer for a research university and is a senior military representative to a nearby commercial reactor. He is also a technical consultant to the Joint Reserve serving the Office of the Secretary of Defense's Director of Defense Research & Engineering (OSD DDR&E) activities, a unit formed four years ago as a panel of subject matter experts. In this role, he serves with other experts to provide additional knowledge, experience and training to DDR&E in technical and economic aspects by brainstorming, war gaming and researching. He uses the web to seek information daily. In his role as technical consultant to DDR&E, he uses DoDTechipedia to develop content pages related to human subjects testing protocols. He works on this task 2-3 times per week and says his skill rate on Techipedia is still developing. He is aware of other DTIC products, but doesn't use them extensively.

Specific Need – Alan recently needed to verify a detail about the proper way to wear his uniform for an event. He frequently needs to look up DoD or Department of the Navy instructions or directives, so he started his search at his usual starting point for this type of search, the Naval Personnel Center Reference Library (http://www.persnet.navy.mil/ReferenceLibrary/). There he finds links to Directives and Instructions and from there to uniform regulations. This takes him less than a minute to locate. The first time he needed this type of information he spent 3-4 minutes to find it via Google.

Exploratory Need – Alan tracks information on an ongoing basis for the team of people who discuss energy commodities – commodities that are critical for the functionality of the US military. In particular, he monitors topics on low tech energy efficiency as well as on R&D spending on new or renewable energy technologies. He looks for information about what production changes are planned for these sources. He begins his search with a Google query for keywords of interest so that he can learn or confirm commodity production schedules to estimate impact on supply chains. He searches for news reports, press releases, and other items that signal manufacturing production changes. For one recent round of research, he initially spent 4 hours, and did not find the answers to his questions. Although he has expertise in the production and use of these resources, he is looking for information on company business plans and strategies. Due to budget limitations within his organization, he does not have direct access to subscription services that could provide analysis regarding that kind information on companies. He participates in listserves as one way to gather information.

4.3 Other Observations and Notes

Several interviewees noted that there is a big difference between the classified, controlled and public environments and this causes a large gap in access to the information needed.

There are policies that limit access to materials and content on DoDTechipedia – restrictions as to who can get on to that site will impact dissemination of this content. This content has been pulled in from various other sites within DoDTechipedia and external to DoDTechipedia but access is limited just to the federal government and contractors. Users are still figuring out how to effectively use the tool – what information can and should be posted in DoDTechipedia.

Cost and context of the need for the information effects how and where to search and to some degree the success in locating the material. Several interviewees commented on not having funds to purchase reports or other materials that were relevant to their search. Instead, they chose to keep looking for freely available equivalent or acceptable alternative information sources.

One contractor stressed that she is very mindful of segregating her sources depending upon who the search is for: she uses appropriate client-based tools or public sources when she searches for client related information, and utilizes her employer's information tools or public information when working on market research analysis projects.

Other tools/sources referenced during the interviews:

- DSTKOL.com
- npc.navy.mil/ - reference library
- blog: Critical Commodities - http://criticalcommodities.com/
- ITIL - Information Technology Infrastructure Library - (ITIL) A method of organizing the system and network management departments of large organizations. ITIL defines the (work) processes involved and the interfaces between them.
- Air Force Portal
- DoD Document search
- DoD Statistics Office
- Intellipedia
- DTIC Research and Development Descriptive Summaries (RDDS) R&D exhibits
- GAO Reports – budget exhibits
- Internal senior level briefings
- Newton – beta tool for project communication and management?

4.4 Discussion

The personas and scenarios highlight important aspects of information seeking behavior for these end-users.

Google is the single most common starting point for these searchers, but they consult many other sources, applying a variety of strategies and tactics. Some of their sources are very specific; others are more general. Searchers have a plethora of sources of authoritative (or authoritative enough) information. The sheer abundance of information may make it impractical for searchers to select one or two best starting points for a search. Indeed, even with bookmarks and other devices, users may not remember which known sources to consult for an information need. In these cases, using a search engine like Google isn't simply because it's easy – it may be the most efficient way to reach the desired information.

At least one potential user of DTIC systems finds the current systems cumbersome, and several other comments hint at this. These comments probably reflect changing user expectations as much as design limitations. They highlight the importance that many end-users place on streamlined designs that get them good, but not necessarily the best, information. In an era when information overload is more of a problem than information scarcity, this may be a rational strategy to minimize the amount of time and effort spent searching.

These end-user searchers are part of a social and collaborative environment. They are not all librarians or information specialists, but they share what they learn with their colleagues. Similarly, they draw on their colleagues for information and suggestions on where to get needed information. This holds even for the non-DoDTechipedia users.

4.5 Application and Limitations

These personas and scenarios are specific examples of information needs drawn from real end-users. These examples may be useful for informing DTIC's planning and service design process. In particular, they may help DTIC to identify unmet information needs and envision new tools and services. The personas and scenarios may also provide useful starting points for usability tests.

The personas and scenarios are not, however, comprehensive in any sense, nor do they fully represent the variety of DTIC end-users and their information needs. These techniques can be used in conjunction with DTIC's established system development processes. The in-depth interviews allow time to explore information needs as well as the context of the needs – an outcome that is hard to achieve in a survey. Focusing on one or two critical incidents helps minimize generalizations and rationalizations. Instead, this can yield specific details that would be overlooked in a focus group or in short format discussions. Using personas instead of specific people can help reduce certain interviewee concerns by making it clear that they are not being asked to speak in an official capacity.

5 Recommendations

The six end-user interviews yielded a detailed set of information needs for a narrow slice of DTIC's end-user community – its "market." I recommend that DTIC continue to develop its understanding of non-traditional end-users and their needs. It can do this by first developing a market segmentation plan that articulates the type of users that DTIC serves within its large and diverse science, technology, research and development, acquisition, and warfighter communities.

Next, DTIC can use the methodology from part 2 of this project to directly contact end-users and develop personas and user scenarios. In particular, it may be helpful to use a "snowball" strategy to identify end-user informants – that is, ask current contacts to suggest additional contacts, and then repeat as needed.

I recommend expanding the target audience to interview a total of 20-30 people (including the initial six). It may be useful to consider additional user profile characteristics and "market segments" as a way to identify potential interviewees. Analyzing the data from a broader set of interviews is likely to yield additional information needs and contexts. These rich descriptions can be used to stimulate discussion of user needs within DTIC. Subsequently, a larger-scale survey may be advisable to validate the interview findings, particularly where the interviews suggest the potential value of new services.

I also recommend that DTIC consider adding end-users to advisory committees and teams like the Customer Interface Task Force where feasible. This will help more directly involve and represent the needs of end-users. It may be useful to establish an ongoing recruitment effort and have end-users serve for a one-year term, to gain continuing access to fresh perspectives, needs and ideas.

As a method for gathering insight into technology developments not yet being discussed in the trade press, DTIC should consider hosting a workshop with experts in the research community. This could particularly focus on changing demographics of DTIC's end-users and potential end-users, the evolving technology and what needs and opportunities these trends presents for DTIC. DTIC should continue to monitor the LIS literature, especially conferences and journals in the area of human computer interaction and information retrieval (HCIR). Researchers are using these to report and discuss new systems, tools, techniques and issues. Tomorrow's enterprise-scale search interfaces are being envisioned, designed and evaluated in these venues.

Finally, DTIC should continue the practice of environmental scans, including research journals related to information needs and behaviors, especially of the "Millennial" and succeeding generations. These would include journals, conferences and workshop in the LIS field, as well as education, sociology, human-computer interaction (HCI), psychology, and other fields.

6 Conclusion

This project has critiqued elements of DTIC's current requirements gathering practices, suggesting some modest refinements. As noted above, this critique was narrowly focused on aspects related to user needs, so this report should not be considered comprehensive of the broader requirements analysis or design process. A literature review was used to extend our understanding of user needs identification to DTIC's domain: defense-related information seeking, and several techniques were recommended for use in an exploratory study. The exploratory study demonstrated the efficacy of these techniques, yielding personas and user scenarios that illustrate important user characteristics and needs and contributing to DTIC's understanding of the current and future user needs of its user communities.

7 Acknowledgements

Abbey Gerken and Elizabeth McLean assisted in the data collection and analysis for this project. I am grateful for the time and assistance of the DTIC staff and end-users interviewed for this project. This research was supported by DTIC contract CSA#S935000009. The findings and recommendations expressed in this report reflect my own professional opinions.

8 References

Burroughs, J. (2009). "What users want: Assessing government information preferences to drive information services." *Government Information Quarterly*, 26(1) 203-218.

Carrol, J.M. (2000) *Making use: Scenario-based design of human-computer interaction.* Cambridge, Massachusetts: The MIT Press.

Constantine, L. L. and Lockwood, L.A.D. (1999) *Software for Use: A Practical Guide to the Models and Methods of Usage-Centered Design.* New York: ACM Press.

Cooper, A., Reimann, R., and Cronin, D. (2007) *About Face 3: The Essentials of Interaction Design.* Indianapolis, Indiana: Wiley Publishing, Inc.

Dearstyne, B. (2005). "Fighting terrorism, making war: Critical insights in the management of information and intelligence" *Government Information Quarterly*, 22 (2) 170-186.

Dolgoff, S. (1997) "Taming the Information Firehose" *Command and Control for 2000 and Beyond*, DTIC Paper. Retrieved April 5, 2010 from http://handle.dtic.mil/100.2/ADA325829.

Feinberg, L. (2004). "FOIA, federal information policy, and information availability in a post-9/11 world." *Government Information Quarterly*. 21(4) 439-460.

Hayes, R. (1992). "The defense logistics agency and the federal catalog system." *Government Information Quarterly*, 9(3) 291-303.

Kahan, J., Worley, D.R., Stasz, C. (1989) "Understanding Commanders' Information Needs" DTIC Publication. Retrieved April 5, 2010 from http://handle.dtic.mil/100.2/ADA379689.

Kaiser, F. (2003). "Access to classified information: seeking security clearances for state and local officials and personnel." *Government Information Quarterly*. 20(3) 213-232.

Kuylenstierna, J., Rydmark, J., Sandström, H. (2004) "Selection of Information for Command and Control", Paper presented at the 9th International Command and Control Research and Technology Symposium Coalition Transformation: An Evolution of People, Processes and

Technology to Enhance Interoperability. Retrieved April 5, 2010 from http://www.dodccrp.org/events/9th_ICCRTS/abstracts/065.pdf.

McWilliams, P. (1991). "Controlling and disseminating information in the Department of Defense." *Government Information Quarterly*. 8(2) 183-190.

Molholm, K. (1995). "The defense technical information center: Expanding its horizons." *Government Information Quarterly*, 12(3) 331-344.

Sharp, H., Rogers, Y., and Preece, J. (2007) *Interaction Design: Beyond Human Computer Interaction.* 2nd ed. Chichester, West Sussex, England: John Wiley & Sons, Ltd.

Sinclair, K. (1997) *Information and the Future of Battle Command.* Retrieved April 5, 2010 from http://handle.dtic.mil/100.2/ADA331389.

Stair, R.M. and Reynolds, G.W. (2008) *Principles of information systems: A managerial approach.* Boston: Thomson Course Technology.

Statement of Work: Investigation of Exploratory Information Needs and Information-seeking Scenarios of DTIC End-users (Revised July 16, 2009).

Stowsky, J. (2004). "Secrets to shield or share? New dilemmas for military R&D policy in the digital age." *Research Policy*, 33(2) 257-269.

Thoms, G. (2003) "Situation Awareness - a Commander's View" ISIF 1094-1102. Retrieved April 5, 2010 from http://www.isif.org/fusion/proceedings/fusion03CD/special/s114.pdf.

Westbrook, L. (2001) *Identifying and Analyzing User Needs.* New York: Neil Schuman.

Walters, S. (2004) *Library Marketing That Works!*. New York: Neil Schuman.

Appendix A – Documents Reviewed

The following documents were reviewed during part 1:

- DTIC Strategic Plan 2007-2012
- Mission and Functions, September 2007
- 2008 Customer Satisfaction Survey
- Technical report "Current Searching Methodology and Retrieval Issues: An Assessment" (March 2008)
- Documents from FAST executive briefing, including "The 11 Possible Enhancements in order of priority" (July 15, 2009)
- Consolidated Search Requirements (requirementsconsolodated090512.xls)
- DTIC Online web site (www.dtic.mil)

Appendix B – Part 2 Activities Description

The findings of Part 1 of this investigation suggest that DTIC has effective mechanisms for identifying the needs of its expert users: the librarians and information professionals who are often intermediaries working on behalf of the end-user. The needs of informal searchers are not as well understood as the needs of the professionals. It is not clear who comprises the informal searchers. DTIC's User Services Directorate indicates that, "We usually advertise that we target the science, technology, research and development, acquisition, and warfighter communities. Our Web page refers to serving the warfighter, researchers, scientists, engineers, laboratories, and universities" (private communication). However, we have found no document yet that articulates the types of users DTIC seeks to serve within each of these large and diverse communities. This is an important step in a deeper understanding of the needs of users. Articulating specific user profiles will allow DTIC to explore the information needs of these users and develop rich usage scenarios that complement DTIC's rich understanding of its more traditional users – experts and intermediaries.

This proposal describes two activities that apply techniques reviewed in the Part 1 report. These activities are proposed because they a) will provide useful information for DTIC about end-user needs, b) they are feasible within the budget and schedule constraints, and c) they can (I believe) be accomplished without major logistical challenges (e.g., a survey would require OPM approval).

The two activities are:

1. Develop user profiles and corresponding personas for non-traditional users - by classifying users according to relevant information needs, work contexts, and other characteristics
2. Develop usage scenarios based on the developed user profiles by interviewing non-traditional end-users

The focus of the two activities will be non-traditional users, informal searchers who are not necessarily experts or intermediaries.

Activity 1: User Profiles and Personas

Objective: Develop 3-5 profiles of non-traditional users and corresponding personas

Approach: Identify an initial set of user profiles using the existing (limited) literature and information from Part 1. Review it with selected DTIC staff and refine it. Identify a set of informants (ideally 2-3 per profile) who are representative of these users. If real end-users are not available, it may be sufficient to work with informants who are very familiar with the end-users and their work. Arrange in-person or telephone interviews (approximately 45 minutes per informant) using a semi-structured interview to refine and elaborate the user profiles. Use the profiles to craft personas, and then review the profiles and personas with informants and refine as needed.

Activity 2: Usage Scenarios

Objective: Develop 1-3 usage scenarios for each user profile identified in activity 1.

Approach: As part of the end-user interviews in activity 1, collect in-depth data about information needs, work contexts, search tasks, and other related activities. Compile this data into sample scenarios. Email to respondents (with the profiles and personas) and follow-up with email or phone call to collect feedback on the scenarios, and refine as needed.

Outcomes

The user profiles, personas and usage scenarios will help document the non-traditional users of DTIC resources. Although this information will be based on a small sample of users, it will provide a deeper description of these users which could be complemented with a broader future survey. The profiles, personas and usage scenarios will be useful for ongoing usability tests, as well as for future design efforts.

Appendix C – Part 2 Interview Questions

Semi-structured Interview Questions

Introduction: "Thank you for agreeing to meet with me. I am working with Carol Jacobson to explore the science and technical information needs of people who don't traditionally work directly with DTIC. DTIC targets the science, technology, research and development, acquisition, and warfighter communities. Your participation will help us to better understand the needs of specific users within these diverse communities. I have some questions that will get us started, but we aren't limited by them. We'll see where the conversation goes. Before we get started, do you have any questions? May I record this interview?"

Basic information
- Job title/rank
- Organization – employer & posting agency (if contractor)
- Gender
- Educational level (HS, Bachelors, Masters, PhD, other certifications)
- Age (by decade)
- Years in the field (by decade)

Web information seeking frequency – How often do you use the Web (e.g. a web search engine, browsing) to look for job-related information? [categorize responses according to following:]
- Less than 1/month
- At least 1/month, but less than 1/week
- 1-2 times per week, but less than once a day
- At least once a day

How do you rate your Web information seeking skills?

Novice 1 2 3 4 5 Expert

What DTIC products do you use, e.g. DTIC Online, DTIC Online – Access Controlled, and DoDTechipedia.

General DTIC usage frequency – How often do you use a DTIC product to look for information? [may get multiple product responses]
- Less than 1/month
- At least 1/month, but less than 1/week
- 1-2 times per week, but less than once a day
- At least once a day

How do you rate your skill with the DTIC products you use?

Novice 1 2 3 4 5 Expert

Can you describe your organization and your job responsibilities? (interested in how people

classify themselves (scientists, engineers, information professionals, etc.))

I'd like to ask you about two general kinds of information needs you may have had. First, what is often called a known item or fact-finding need. This is where you need to find a specific document or fact, or get a specific answer to a question. Second, is what we call an exploratory information need. These often are more complex, you might need to find multiple documents, and you might need to look for information in multiple places or conduct multiple searches. You might not even be quite sure of what you are looking for – it might be a bit ambiguous or uncertain. Of course, real information needs aren't cut and dried, so your needs might fall somewhere in between these extremes. We are especially interested if you used DoDTechipedia, Online – Access Controlled or other DTIC products. Can you start by telling me about a known item or fact-finding need? [see sub-questions below] Now can you tell me about a more complex or exploratory need?
[For each need, explore:]

- Goal, source of task – [May need to provide guidance to appropriately describe high level work task that motivated the information need.]
- Type and amount of information needed
- Who needed the information (you personally, colleague, boss, etc.
- Time aspects – frequency (one-time vs. repeated), length, stage, time constraints, urgency
- Importance (salience)
- Complexity (e.g. Bystrom & Jarvelin)
- Difficulty
- Can you characterize your prior knowledge of the domain
- What resources were consulted (human too)?
- How did you ultimately satisfy the need?
- Did you work with others on this information need? In what ways did you collaborate?
- How might this task differ from non-military info needs?
- Effect of any security and confidentiality issues?
- Effect of other organizational policies?

Can you tell me about your DoDTechipedia page? When started? How many people write/read? What kind of research did you do to put together?

May we contact you with follow up questions?

Can you suggest any colleagues who we could contact?